REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*

2. REPORT TYPE
Technical Papers

3. DATES COVERED *(From - To)*

4. TITLE AND SUBTITLE

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

5d. PROJECT NUMBER
1011

5e. TASK NUMBER
0074

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Air Force Research Laboratory (AFMC)
AFRL/PRS
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8. PERFORMING ORGANIZATION REPORT

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)

Air Force Research Laboratory (AFMC)
AFRL/PRS
5 Pollux Drive
Edwards AFB CA 93524-7048

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Leilani Richardson
Unclassified	Unclassified	Unclassified	A		19b. TELEPHONE NUMBER *(include area code)* (661) 275-5015

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. 239.18

(1 item enclosed)

10/110874

MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO) 15 August 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-AB-2001-172**
David Barland, "Orthotropic Mechanical Properties of Uncoated and Ceramic-Coated Uniaxially-Compressed Carbon Cellular Porous Materials"

43rd AIAA/ASME/ASCE/AHS Struct., Struct. Dyn.& Materials Conf. **(Statement A)**
(Denver, CO, 22-25 April 2002) (Deadline: 21 Aug 01)

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PHILIP A. KESSEL Date
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20021119 106

43rd AIAA/ASME/ASCE/AHS Structures, Structural Dynamics, and Materials Conference,
22 - 25 Apr 2002, Denver, CO.

Orthotropic Mechanical Properties of Uncoated and Ceramic-Coated Uniaxially-Compressed Carbon Cellular Porous Materials

Abstract

Porous cellular foams of moderate to high porosity (55%-95%) were investigated to determine orthotropic strength moduli and mechanical response. Uncoated porous samples consisted of reticulated vitreous carbon (RVC) rigidized by pyrolysis of flexible, open-pore organic precursor foams. The organic precursor's reference surface pore density was 100 pores-per-inch (ppi) before uniaxial compression. After compression, substrates contained 6% to 33% solid fraction, which corresponded in the thru-thickness direction to 200 ppi to 1100 ppi, respectively. Ceramic-overlaid samples were constructed by depositing silicon carbide (SiC) via chemical vapor infiltration (CVI) onto 600 ppi and 1000 ppi RVC substrates. The ceramic overlays added solid fractions of 5% and 12%, respectively. Compressive and tensile strengths were measured in-plane and thru-thickness for all materials. Results showed compressive crush strengths of the multi-layer porous materials to be bounded between theoretical strengths of solid RVC substrate and SiC-coated materials. Predictions from currently accepted cell anisotropy relations were compared to experiment and are shown to greatly over-predict the orthotropy due to uniaxial compression. The data may be applied to allow more precise design of components using ceramic-coated porous cellular materials.